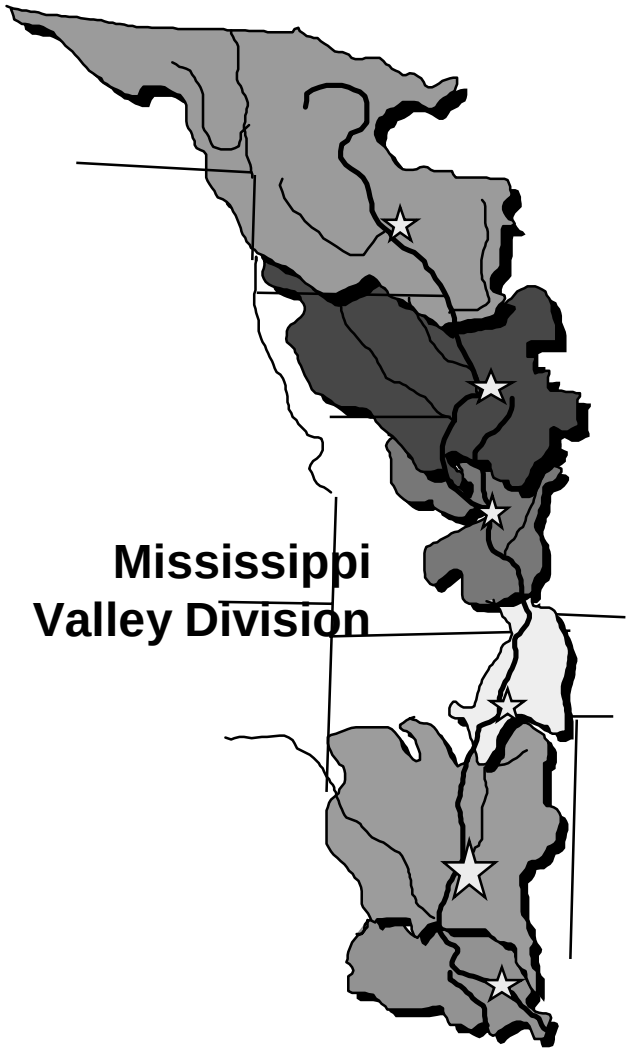
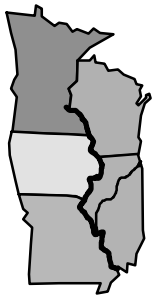
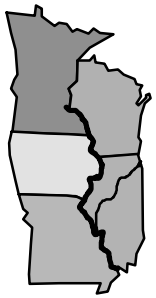




Tools for Adaptive Management on the Upper Mississippi River System

Ken Barr 16 July 2002

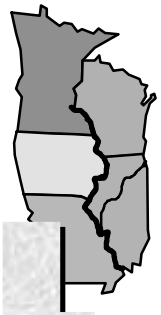
Rock Island District



National Significance of Upper Mississippi River System

"… the intent of Congress to recognize that system as a nationally significant ecosystem and a nationally significant commercial navigation system. … shall be administered and regulated in recognition of its several purposes."

Citation: Water Resources Development Act of 1986, Section 1103(a)(2).



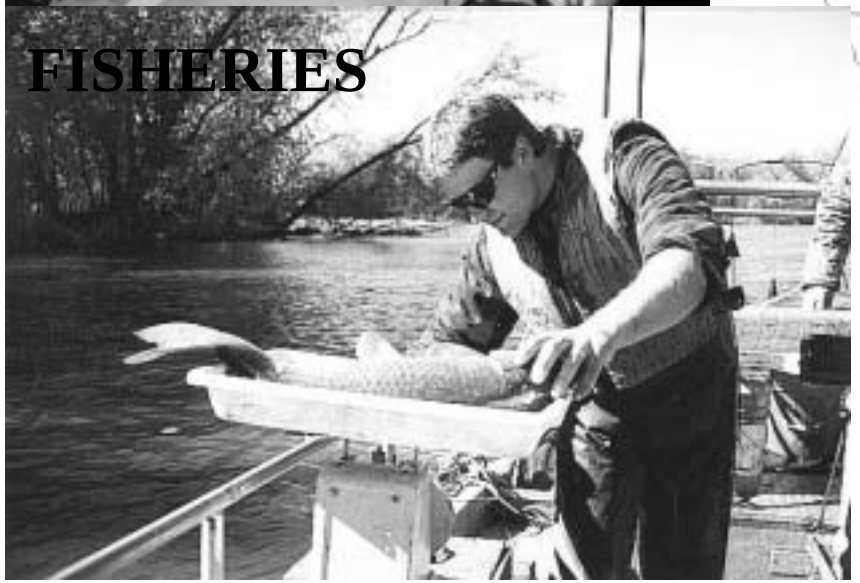
ENVIRONMENTAL MANAGEMENT PROGRAM (EMP)

LONG TERM RESOURCE MONITORING PROGRAM (LTRMP)

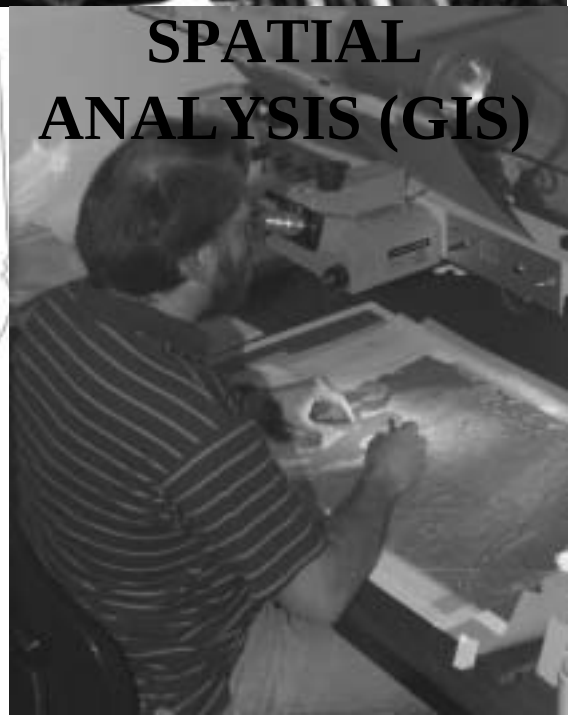
- ✓ ***Monitoring***
- ✓ ***Data Analysis***
- ✓ ***Applied Research***
- ✓ ***Mapping***
- ✓ ***Information Clearinghouse***


WATER QUALITY


VEGETATION


FISHERIES


Minnesota
Wisconsin
Lake City
Field Station
Onalaska
Field Station
Iowa
Bellevue
Field Station
Havana
Missouri
Great Rivers
Field Station
Illinois
Open River
Field Station


SPATIAL
ANALYSIS (GIS)

HABITAT REHABILITATION AND ENHANCEMENT PROJECTS (HREP)

- ✓ Increase habitat diversity (wetland, aquatic, and benthic)
- ✓ Provide off-channel over wintering and spawning habitat
- ✓ Provide reliable floodplain wetlands and associated food resources
- ✓ Create additional shelter zones and nesting sites
- ✓ Increase numbers of mast producing trees

SUMMARY 1988-1998

24 projects completed

28,000 acres of habitat

14 projects under construction

40,000 acres of habitat

12 projects in design

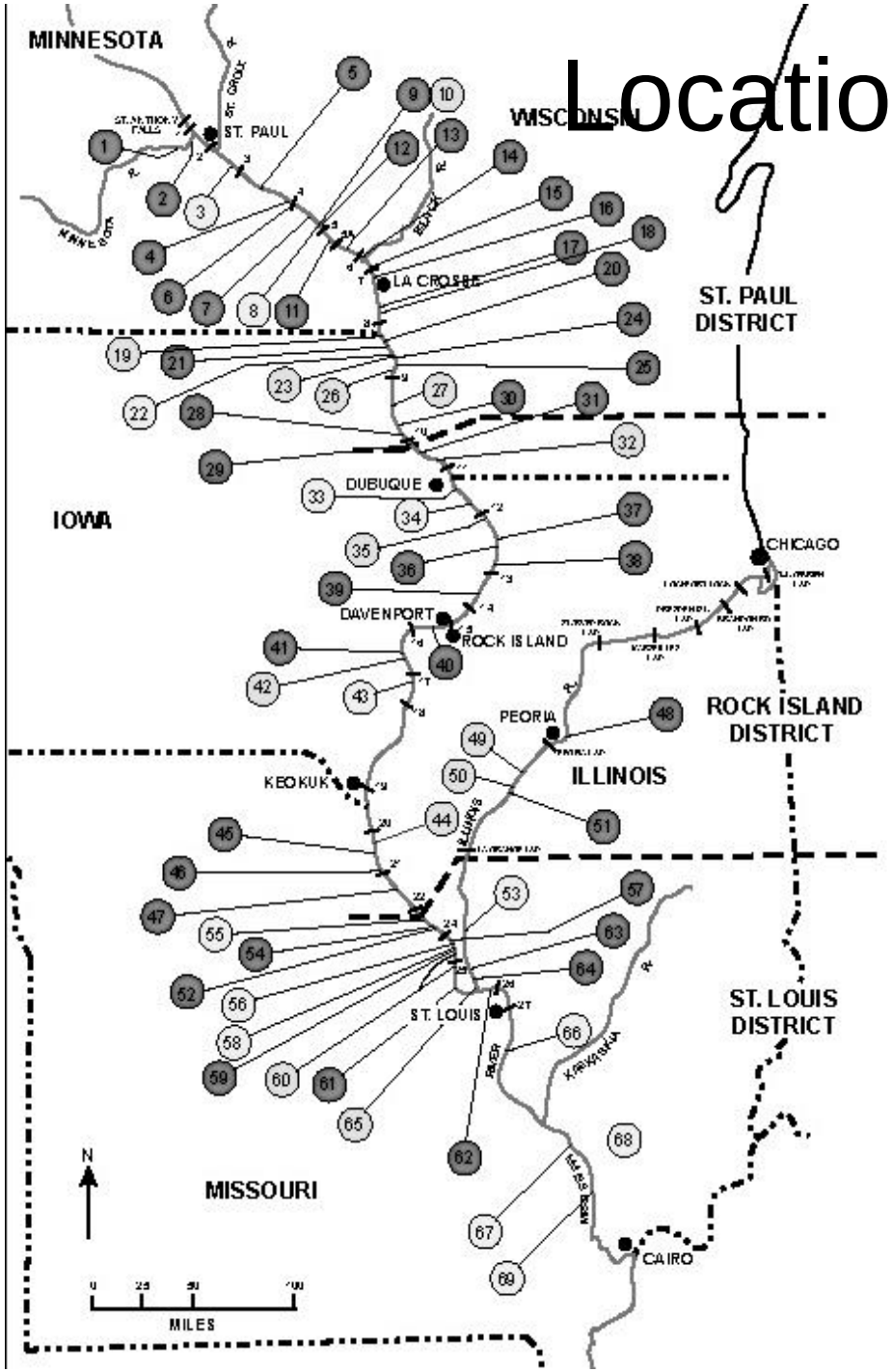
29,000 acres of habitat

50 Projects Total Acres: 97,000+

Per project range of investment: $56,000 - $13 million+

(majority of projects completed to date: $1-4 million range)

Locations of EMP Projects



HABITAT REHABILITATION AND ENHANCEMENT PROJECTS

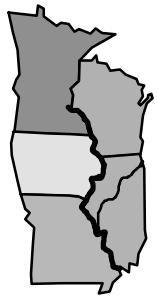
SITE NO.	PROJECT	SITE NO.	PROJECT
1.	RICE LAKE, MN	35.	PLEASANT CREEK, IA
2.	LONG MEADOW LAKE, MN	36.	BROWN'S LAKE, IA
3.	GOOSE LAKE, MN	37.	SPRING LAKE, IL
4.	PETERSON LAKE, MN	38.	POTTERS MARSH, IL
5.	INDIAN SLOUGH, WI	39.	PRINCETON REFUGE, IA
6.	FINGER LAKES, MN	40.	ANDALUSIA REFUGE, IL
7.	ISLAND 42, MN	41.	BIG TIMBER, IA
8.	WHITE/BAXTER RIVER, MN	42.	LAKE DEBSA, IA
9.	SPRING LAKE PENINSULA, WI	43.	HURON ISLAND, IA
10.	SPRING LAKE ISLANDS, WI	44.	GARDNER DIVISION, IL
11.	POLANDER LAKE, MN	45.	COTTONWOOD ISLAND, MO
12.	SMALLSCALE DRAWDOWN, WI	46.	MONKEY CHUTE, MO
13.	TRUMPEAU REFUGE, WI	47.	BAY ISLAND, MO
14.	LONG LAKE, WI	48.	PEORIA LAKE, IL
15.	LAKE ONALASKA, WI	49.	BANNER MARSH, IL
16.	EAST CHANNEL, MN/WI	50.	RICE LAKE, IL
17.	POOLS ISLANDS, PHASE I, WI	51.	CHAUTAUQUA REFUGE, IL
18.	POOLS ISLANDS, PHASE II, WI	52.	CLARKSVILLE REFUGE, MO
19.	POOLS SLOUGH, IA/MN	53.	ALTON POOL, IL
20.	BLACKHAWK PARK, WI	54.	PHARRS ISLAND, MO
21.	LANSING BIG LAKE, IA	55.	ANGLE BLACKBURN, MO
22.	CONWAY LAKE, IA	56.	NORTON WOODS, MO
23.	CAPOLI SLOUGH, WI	57.	STAG & KEETON ISLANDS, MO
24.	POOLS ISLAND, WI	58.	SANDY CHUTE, IL
25.	COLD SPRINGS, WI	59.	BATCHTOWN MGMT. AREA, IL
26.	HARPERS SLOUGH, IA/WI	60.	POOLS 25 & 26, MO
27.	AMBROUGH SLOUGH, WI	61.	CUIVRE ISLAND, MO
28.	BUSSEY LAKE, IA	62.	DREESER ISLAND, MO
29.	GUTTENBERG PONDS, IA	63.	STUMP LAKE, IL
30.	MISS RIVER BANK STABILIZATION, IA/MN/WI	64.	SWAN LAKE, IL
31.	BERTOM-McCARTNEY LAKES, WI	65.	CALHOUN POINT, IL
32.	POOL 11 ISLANDS, IA/WI	66.	OSBORNE SIDE CHANNEL, IL
33.	PEOSTA CHANNEL, IA	67.	LEAST TERN, MO
34.	POOL 12 OVERWINTERING, IA-IL	68.	STONE DIKE ALTERATIONS, MO/IL
		69.	SCHENIMANN CHUTE, MO

STATUS AS OF: SEPTEMBER 1999

- UNDER CONSTRUCTION OR CONSTRUCTED
- GENERAL DESIGN INITIATED
- FUTURE OPPORTUNITIES (NOT ALL SHOWN)
- LOCK & DAM SITES

42
13
+ 14
69

Environmental Management Program
Habitat Rehabilitation and Enhancement Projects



Performance Evaluation Process and Procedure

Dan Holmes, P.E

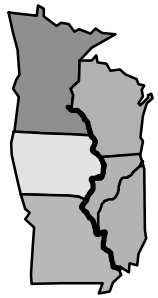
Rock Island District, U.S. Army Corps of Engineers

EMP Workshop

St. Louis, MO

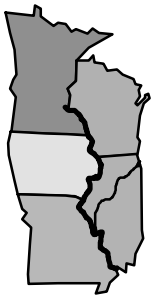
19-21 February 2002

Physical / Chemical



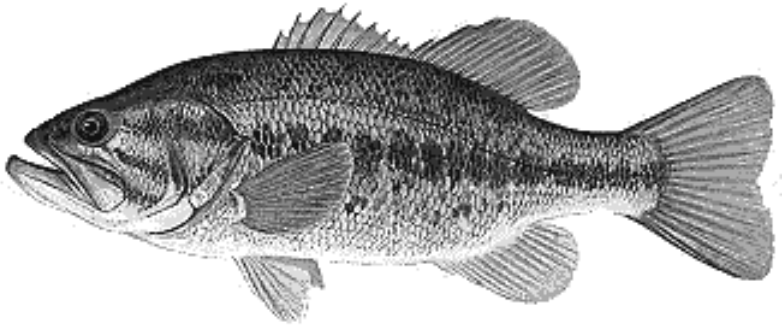
- Hydrology and Hydraulics
  - **Flow Velocity**
  - **Water Levels / Depths**
  - **Sedimentation Depths**
  - **Wave Heights**
- Water Quality
  - **Dissolved Oxygen**
  - **Suspended Solids**
  - **Temperature**
  - **ph**
  - **Column settling analyses**
  - **Chlorophyll**
  - **Total Alkalinity**
  - **Secchi Disk**
- Geotechnical
  - **Sediment classification**
  - **Water content**
  - **Soil strengths**
  - **Bulk sediment**
- Spatial
  - **Aerial photos / remote sensing**

Biological Response Monitoring



http://waterfowl.virtualave.net/menuducks_e.html

Waterfowl



http://www.state.ia.us/dnr/organiza/fwb/fish/iafish/iafish.htm#minnow

Fish

Planted Vegetation

Performance Evaluation Scheduling

Full Reports (Years from Construction Completion)

1

3

5

7

10

15

20

25

35

50

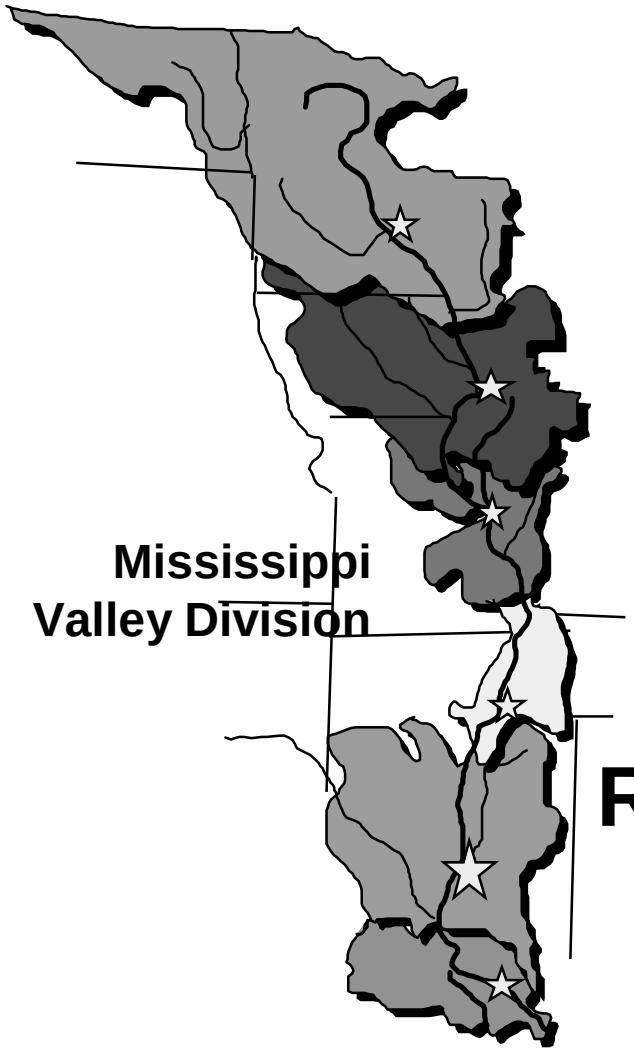
Abbreviated Reports: All other years

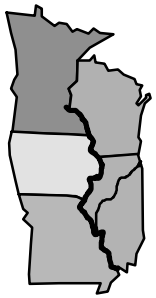
Project Performance Monitoring $ as a Percentage of Total EMP $ (based on 1997 Rpt to Congress projection thru 2002)

- **EMP program ~ $238 M**
- **LTRMP ~ $78M**
- **HREP funding ~ $144 M (61% of total program)**
- **Performance monitoring (phys/chem/bio) ~ $6.8 M (5% of HREP or 3% of total program)**
- **Biological monitoring* ~ $1.7 M (25% of Perf Mon, 1% of HREP, or <1% of total program**

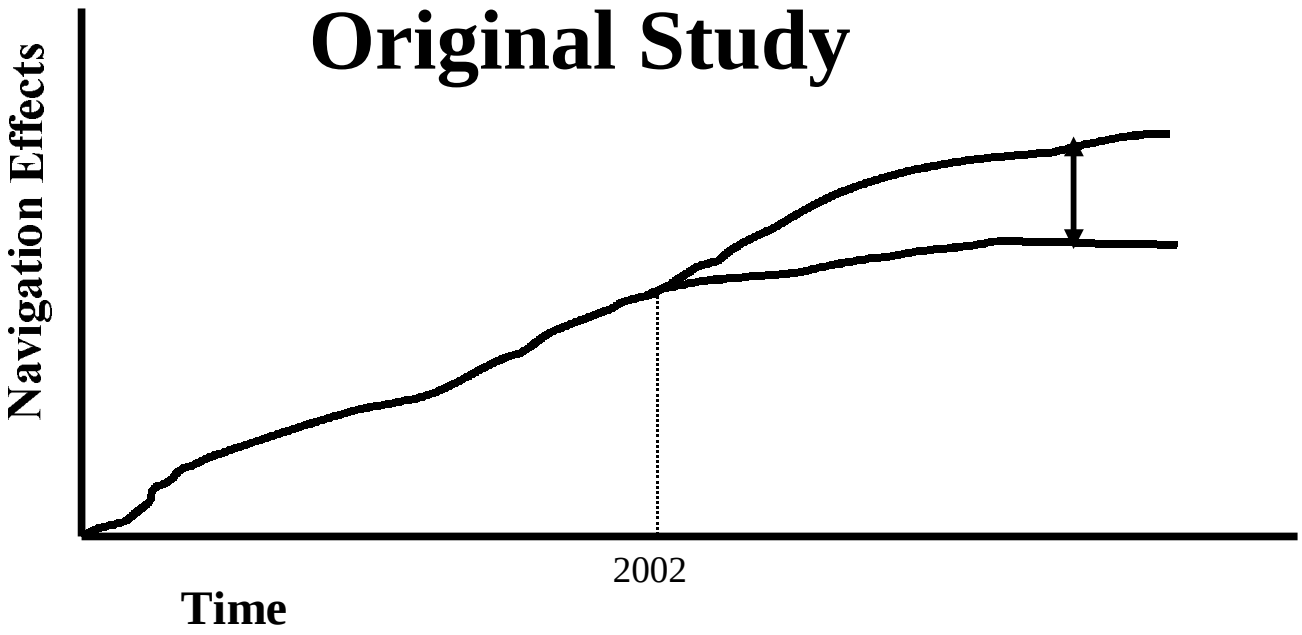
*** [Biological monitoring conducted at ~20-25% of HREPs**

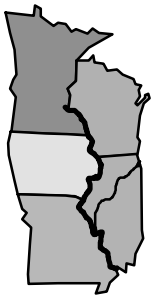
Parameters monitored include fisheries (field collection and creel surveys), birds (aerial and ground surveys), and vegetation (photointerpretation and ground surveys of planted vegetation)]

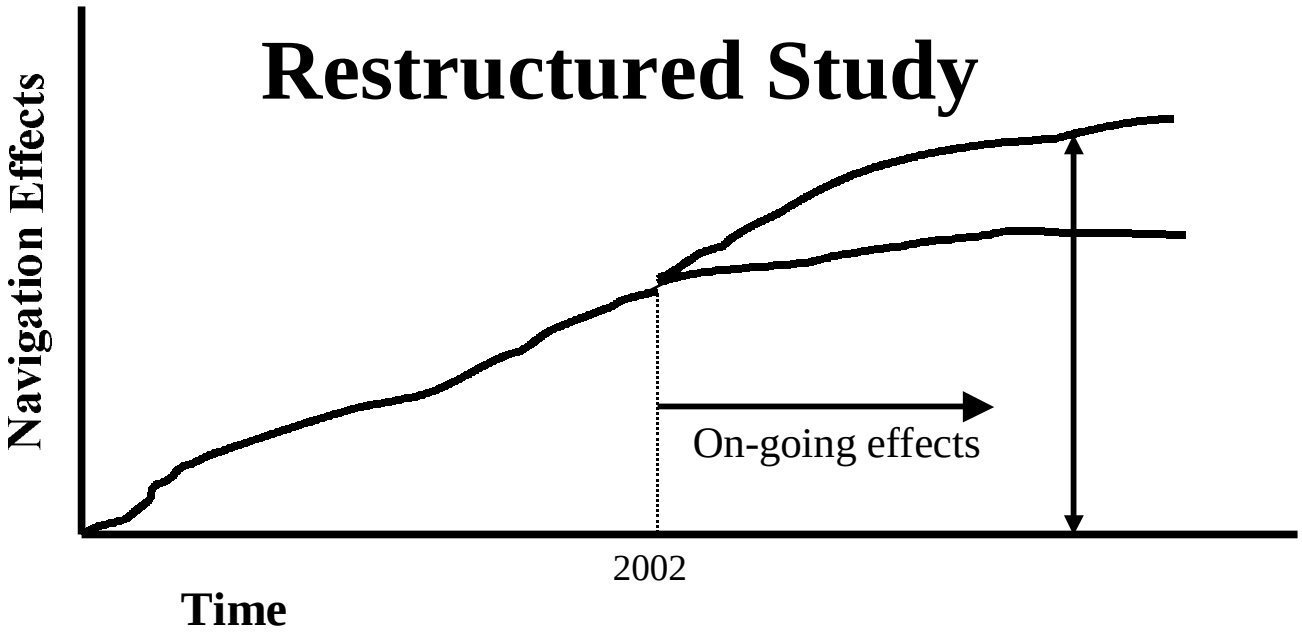




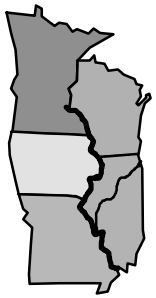
Upper Mississippi River - Illinois Waterway Restructured Navigation Study

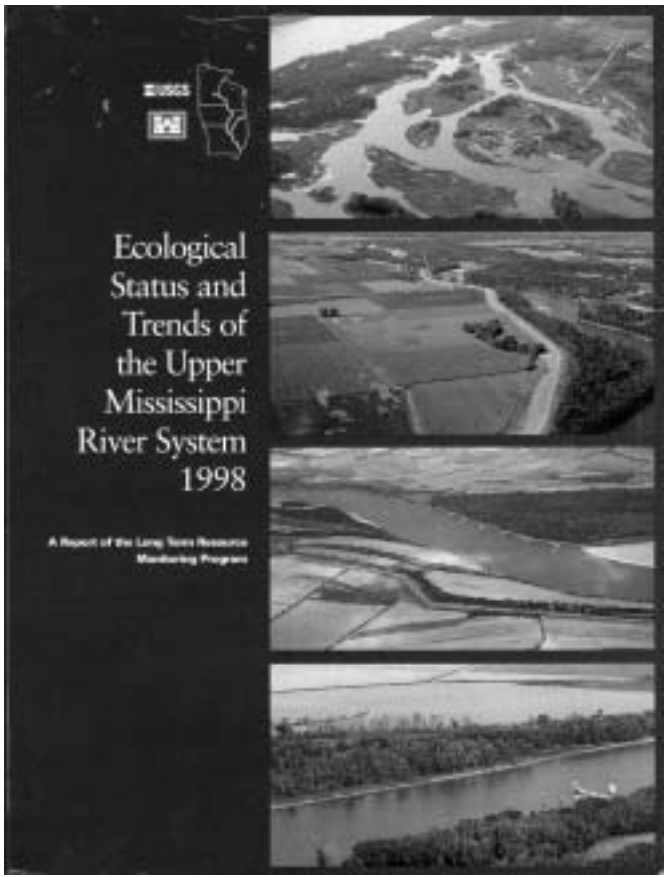

Original Study
Navigation Effects
2002
Time

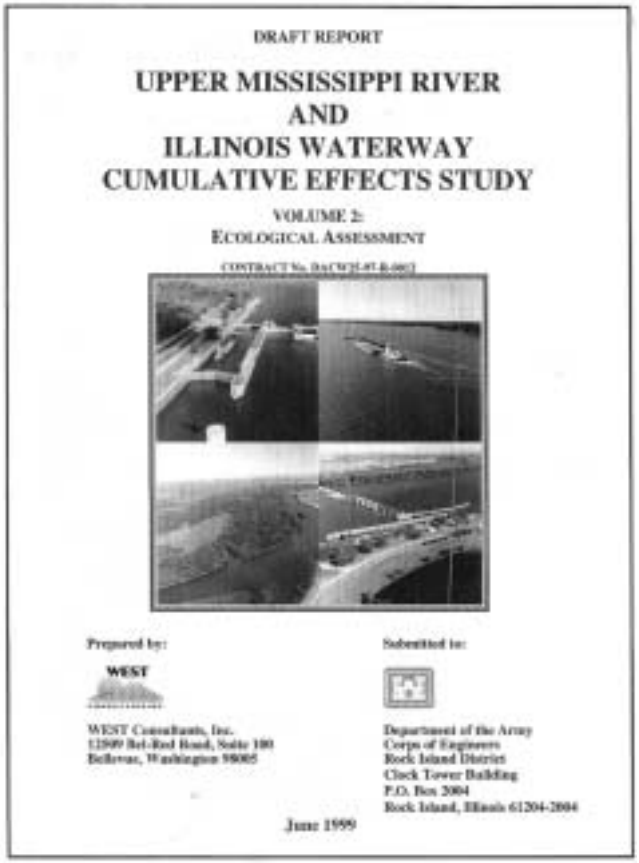



Restructured Study
Navigation Effects
On-going effects
2002
Time

Forecasting the Future Environment



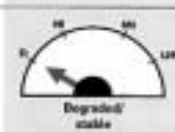
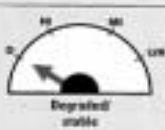
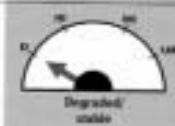




Status and Trends Report

Cumulative Effects Study

Table 16-1. Status report on the ecological health of four floodplain reaches of the Upper Mississippi River System using a gauge grading system.

Criteria	Upper Mississippi River: Upper Impounded Reach (Pools 1-13)	Upper Mississippi River: Lower Impounded Reach (Pools 14-26)	Upper Mississippi River: Unimpounded Reach	Illinois River: Illinois River Lower Reach
Ecosystem				
1. Viable native populations and their habitats	 Declining structural diversity; zebra mussels threatening native mussels	 Floodplain habitat moderately altered by levees; forest diversity limited	 Floodplain habitat greatly altered by levees; side channels closed	 Aquatic vegetation, invertebrates, waterfowl degraded
2. Ability to recover from disturbances	 Recovery demonstrated by invertebrates and aquatic vegetation	 Limited regeneration of willows and cottonwoods	 Willows and cottonwoods regenerating	 Neither aquatic plants nor invertebrates have recovered from 1950s disturbances
3. Ecosystem sustainability	 Habitat quality declining as pools slowly age	 Greater sediment loads increase pool aging rates	 Incidence of greater floods and lower low-flows increasing	 Reduced point-source pollution offset by high sediment loads
Floodplain River				
4. Capacity to function as part of a healthy basin	 Least amount of basin land-cover change	 Land-cover change has altered water and materials delivery	 Land-cover change and Missouri River dams have altered water and sediment delivery	 Land-cover change has altered water and material delivery
5. Annual floodplain connectivity	 Low-flow; floodplain drying eliminated by impoundment; 3% of floodplain leveed	 Low-flow; floodplain drying eliminated by impoundment; 53% of floodplain leveed	 Flood-pulse value reduced by rapid water-level changes; 82% of floodplain leveed	 Low-flow floodplain drying eliminated by impoundment; 50% of floodplain leveed
6. Ecological value of natural disturbances	 Ecological value of floods reduced by channel stabilization; low stages eliminated	 Ecological value of floods reduced by channel stabilization; low stages eliminated	 Ecological value of floods reduced by channel stabilization	 Ecological value of floods reduced by channel stabilization; low stages eliminated

Change indicator

= Stable

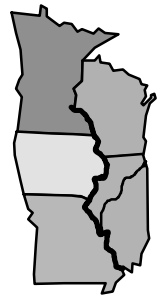
= Declining

= Improving

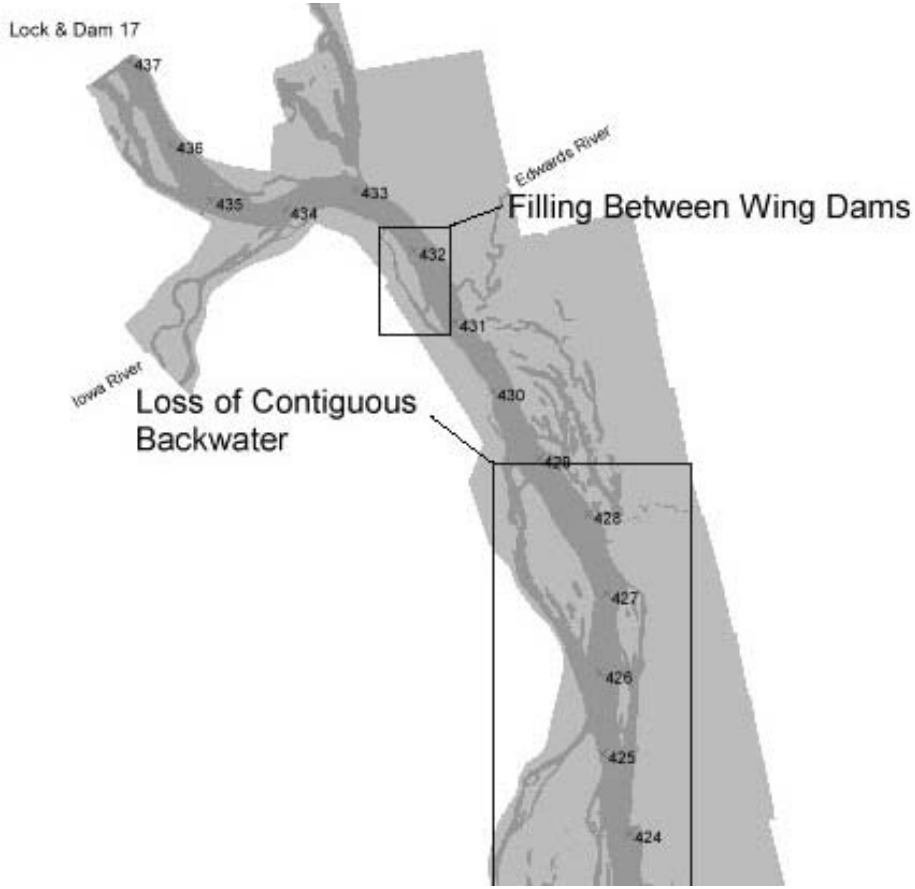
Present status

D = Degraded
HI = Heavily Impacted
MI = Moderately Impacted
U/R = Unchanged/Recovered

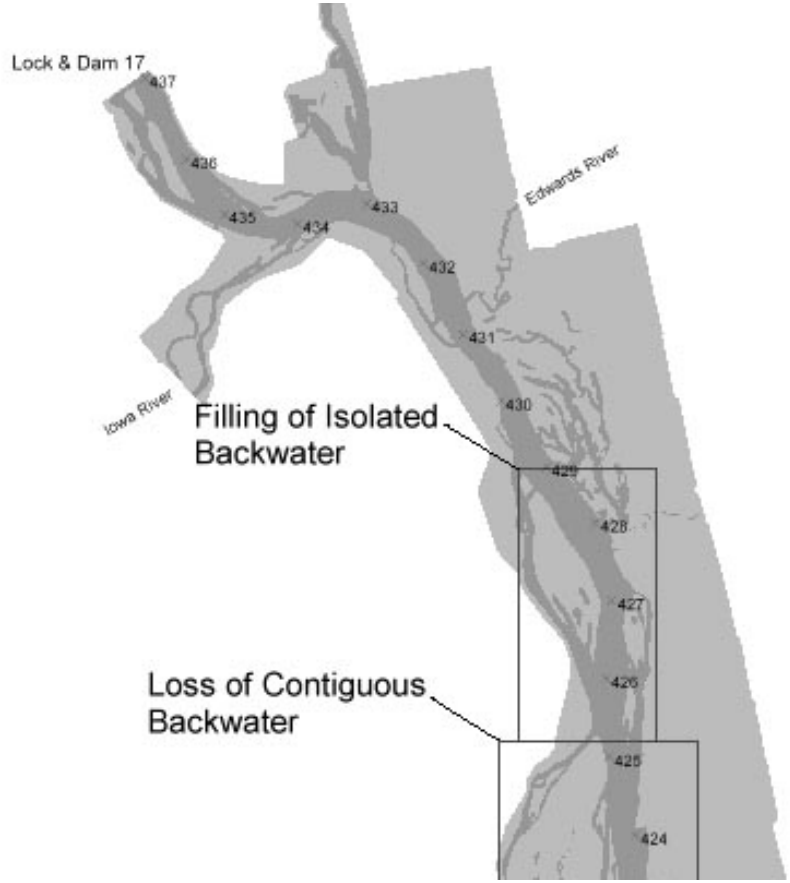
Cumulative Impacts



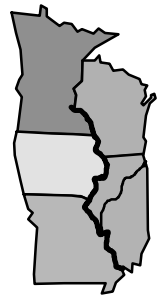
Historical Changes
Mississippi River - Pool 18
Post-Dam - 1989



Projected Changes
Mississippi River - Pool 18
1989 - 2050



Goals and Objectives



Overall Goal

•Sustainable River System

Ecosystem Goals

•Maintain native ecosystem types

•Maintain viable populations of native species

•Restore and maintain ecological processes

•Integrate human use within these constraints

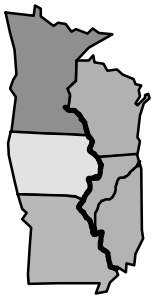
Measurable Objectives

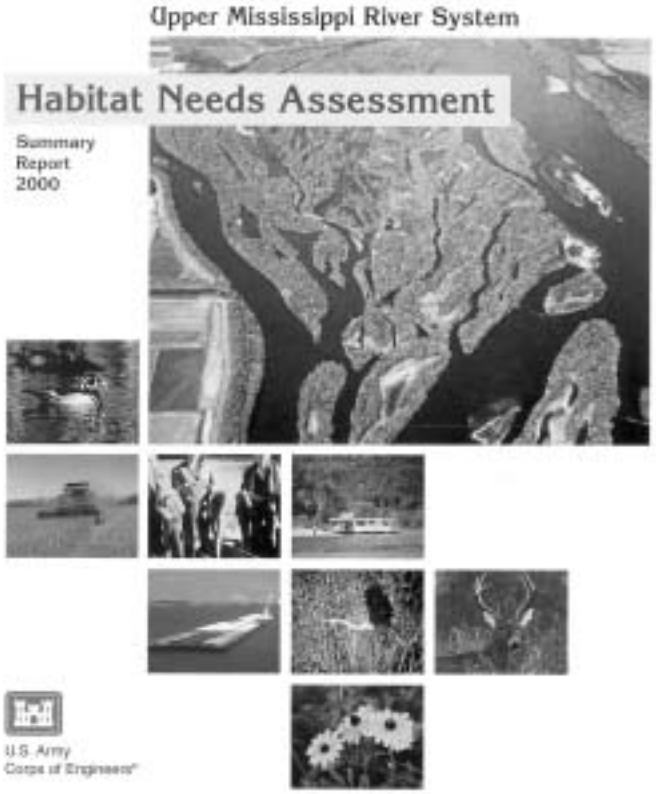
•Spatially explicit

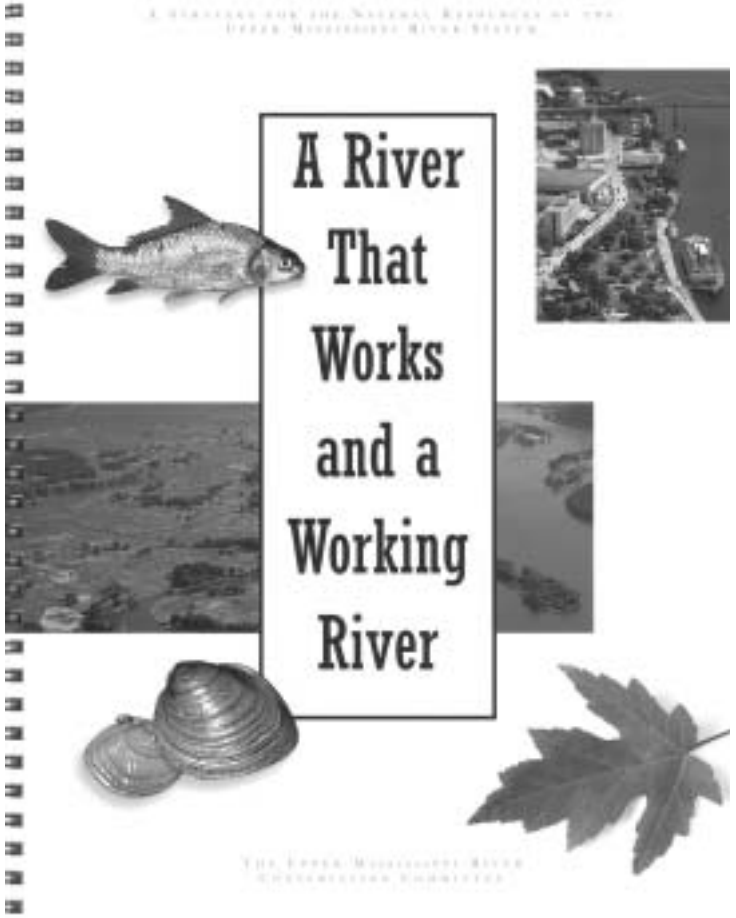
•Quantitative

•Time-bound

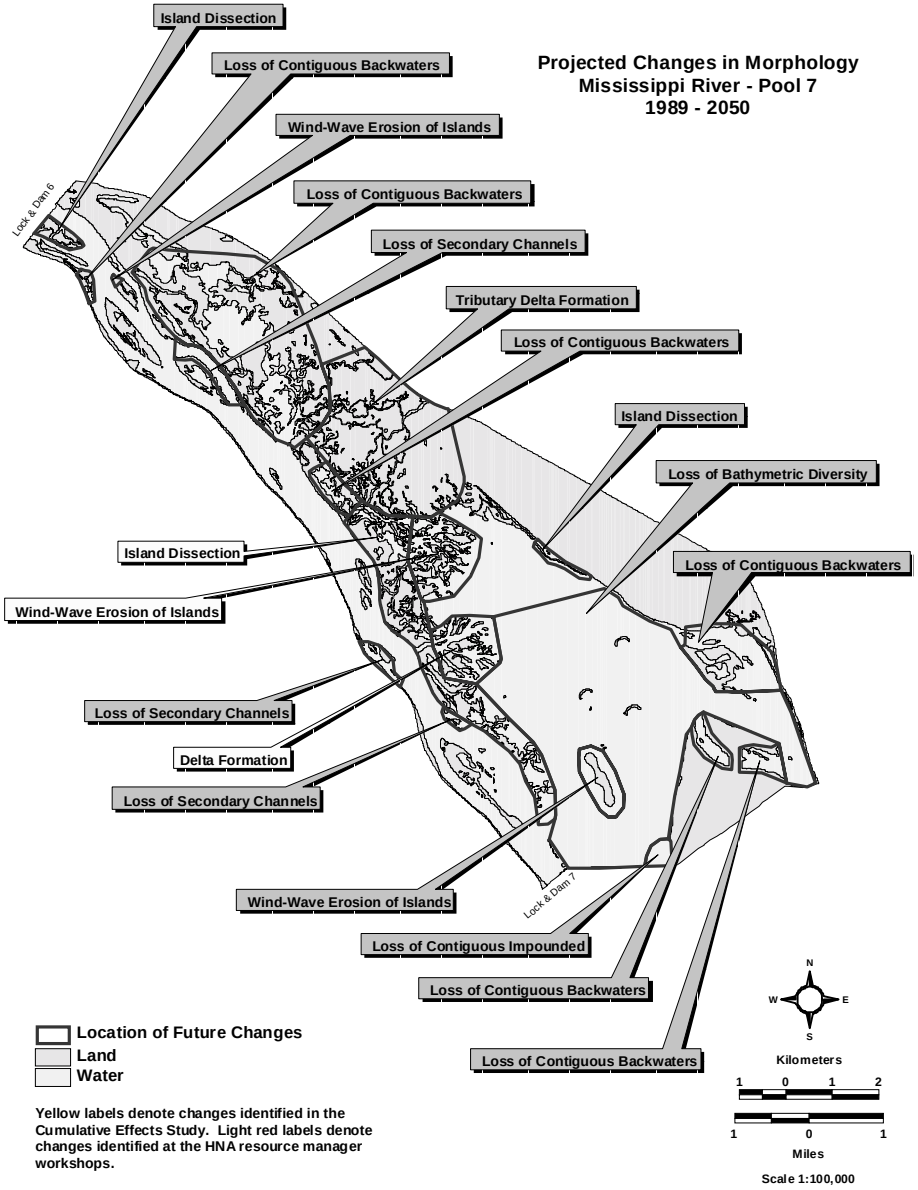
Consideration of Other System Planning Efforts







Qualitative Geomorphic Change Analysis and Future Prediction



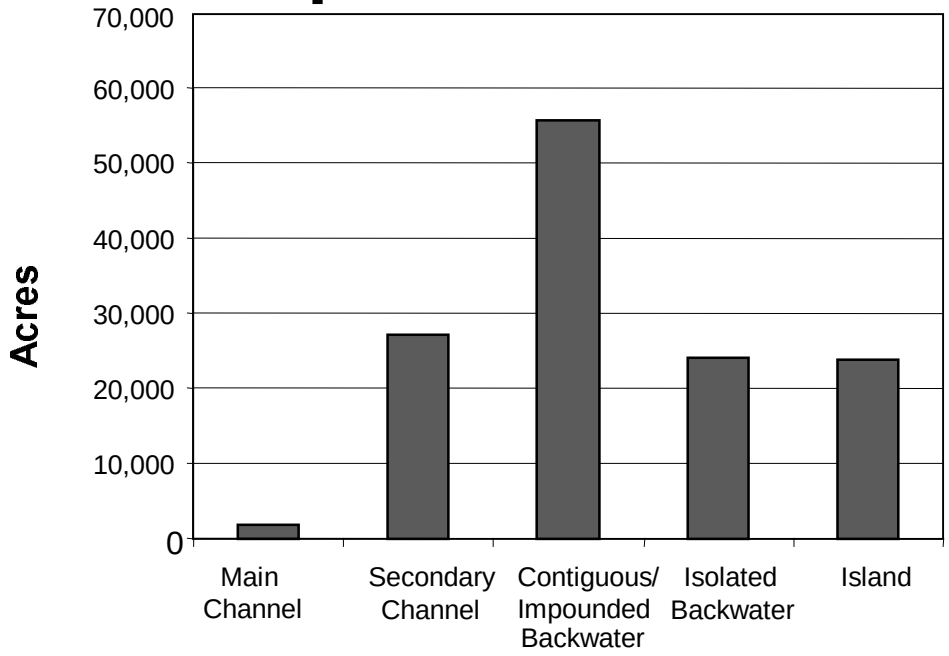
Natural Resource Managers

Geomorphic Process	Number of Occurrences
Channel Formation	3
Delta Formation	3
Filling between Wing Dams	34
Island Dissection	15
Island Formation	20
Island Migration	4
Loss of Contiguous Impounded	9
Loss of Bathymetric Diversity	12
Loss of Contiguous Backwaters	153
Loss of Isolated Backwaters	49
Loss of Cont/Iso Backwaters	32
Loss of Secondary Channels	116
Loss of Tertiary Channels	5
Shoreline Erosion	8
Tributary Delta Formation	43
Wind-Wave Erosion of Islands	25
Total	**531**

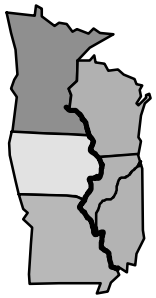
Resource Manager's Desired Future Condition

- Improved Habitat Quality
- Increased Habitat Diversity
- Naturalized Hydrologic Regime

UMRS Aquatic Habitat Need



Previous UMRS Planning Goals and Objectives or Evaluation Criteria



HNA (Quantitative):

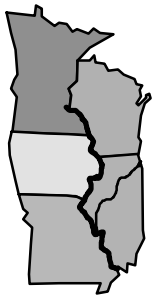
System-wide Habitat Needs

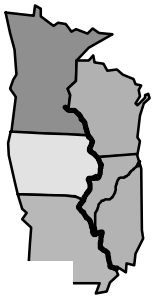
Create or restore:

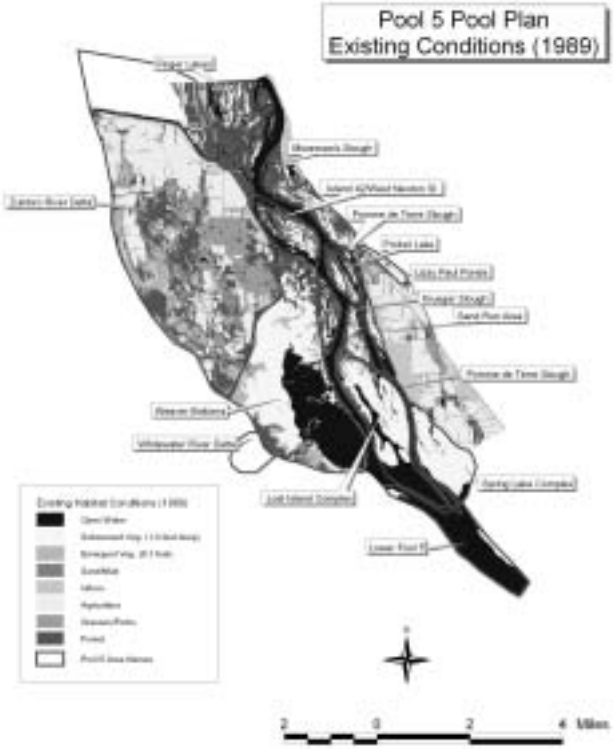
- **1,700 acres of main channel habitat**
- **27,000 acres of secondary channel habitat**
- **55,500 acres of contiguous backwater**
- **24,000 acres of isolated backwater habitat**
- **24,000 acres of island habitat**

Components of A Strategy for Operation and Maintenance of the UMRS Ecosystem

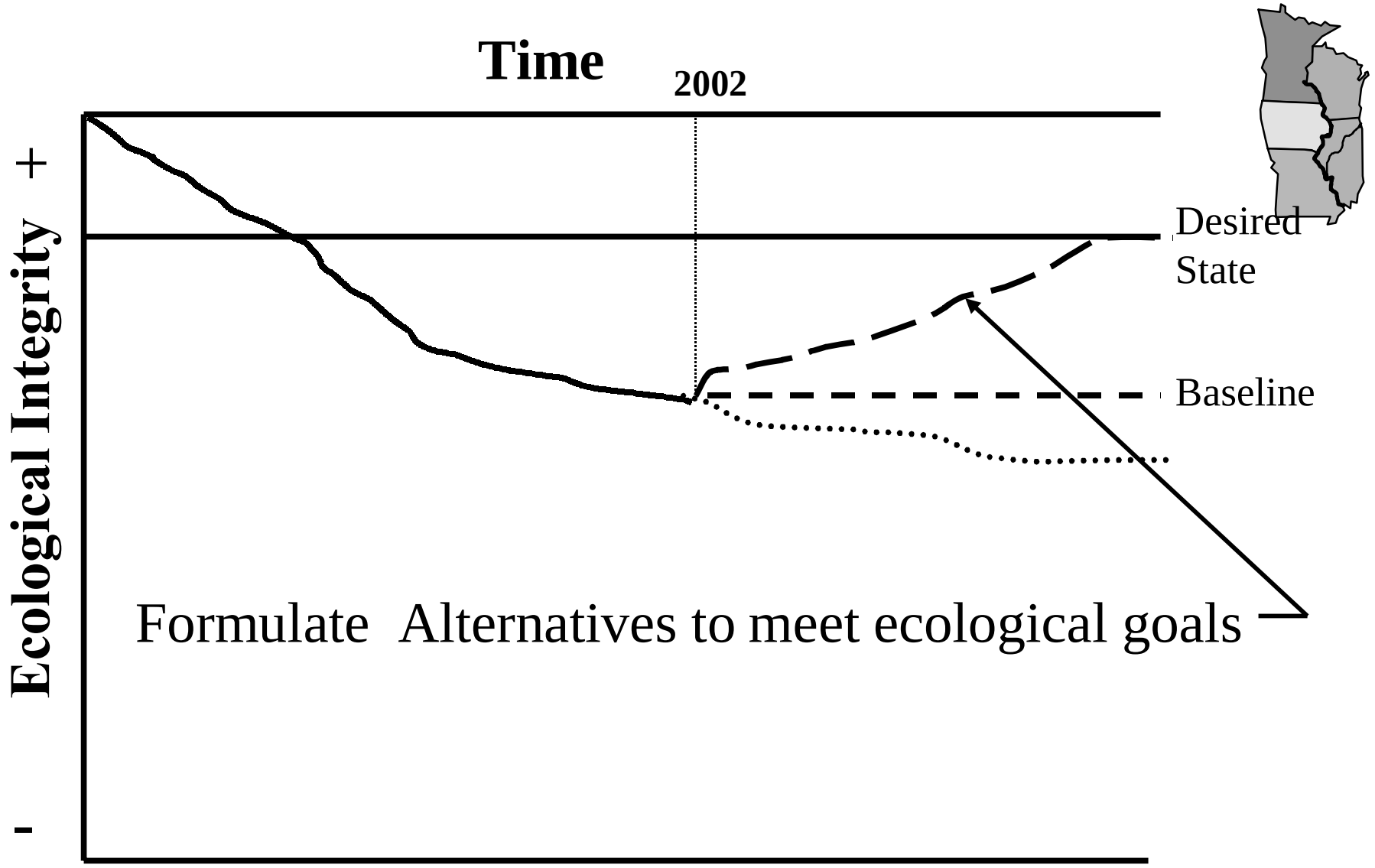
Objectives	Tools or Measures	Goals and Benefits
1 Improve water quality for all uses.	More effective use of federal/state/local tools.	Meet Clean Water Act goals by 2010
2 Reduction in erosion and sediment impacts.	More effective use of federal/state/local tools.	Target programs for improved results by 2010
3 Return of natural floodplain to allow channel meanders and habitat diversity.	Implement 3-step effort: moratorium, no-net-loss, and acquisition from willing sellers.	Increase of 60,000 acres of floodplain forest and wetlands by 2010 and reduced flood damages
4 Provide for seasonal flood pulse effect and periodic low flows to improve nutrient base, plant growth and succession.	Design/implement operations at selected dams to mimic natural events and restore floodplain area & connectivity (open river).	Complete five new successful projects resulting in increased biological diversity and improved river health by 2010
5 Enable connectivity of backwaters to main channel.	Incorporate into above measures and augment by site specific projects.	Restore 100,000 acres of aquatic habitat and add recreational benefits by 2010
6 Provide for opening of side channels, create islands, shoal and sandbar habitat.	Use pool modeling and/or backwater dredging, water level controls, islands and channel modifications.	Restore 100,000 acres of sandbar, floodplain forest and island habitat and add recreational benefits by 2010
7 Manage channel maintenance and disposal to support ecosystem objectives.	Seek ways to reduce dredging needs and manage to support ecosystem integrity.	Improve main channel fishery, reduce dredging needs, & test ways to manage for multiple uses
8 Sever the pathway for exotics into and spread within the UMRS.	Use physical barriers or other means. (New area of research and development.)	Economic and environmental benefits based on zebra mussel damages evaluation
9 Provide native fish passages at dams.	Modify dam structure or operations.	Improve populations of specified fish species






Pool 5 Pool Plan
Existing Conditions (1989)
2 0 2 4 Miles


Pool 5 Pool Plan
Desired Future Conditions
2 0 2 4 Miles


Time
2002
Ecological Integrity
+
-
Desired State
Baseline
Formulate Alternatives to meet ecological goals
Time

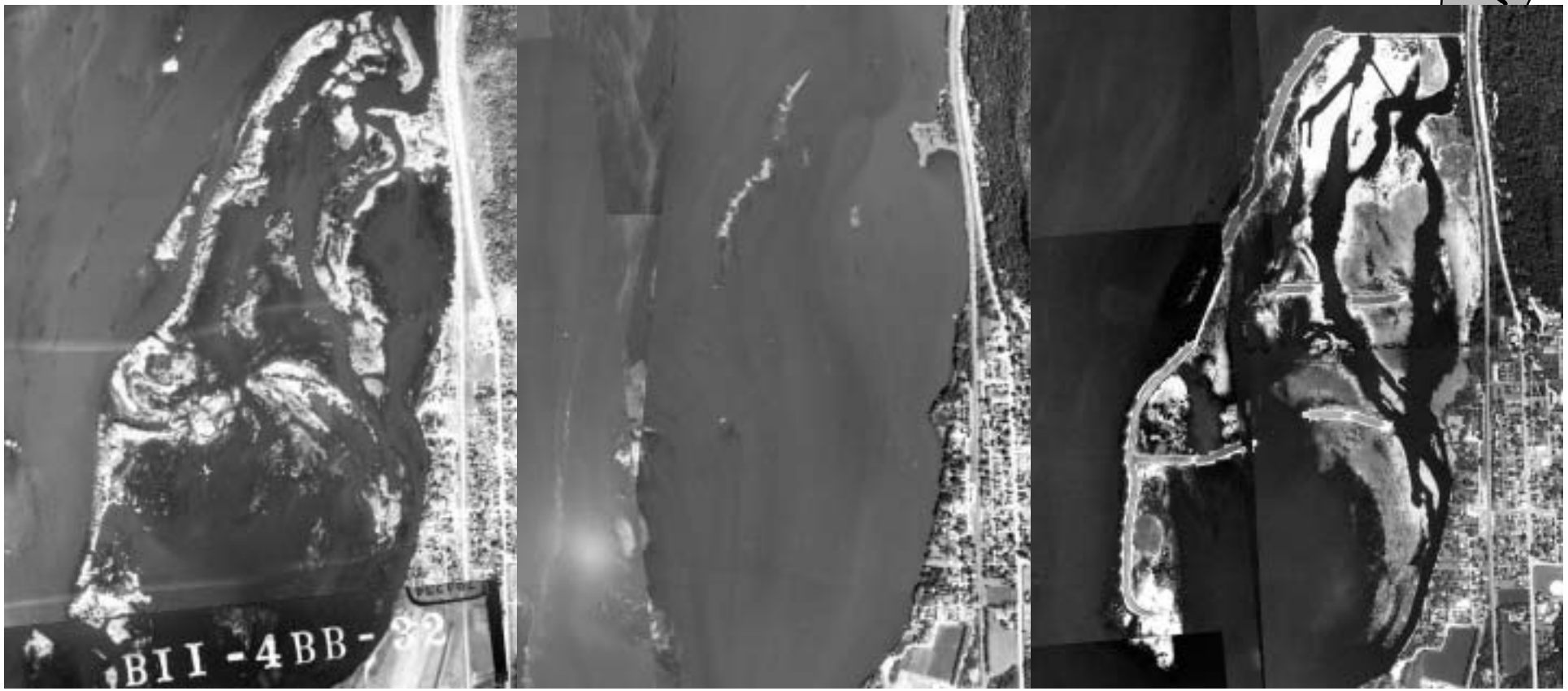
Not to Scale

Water Level Management to Improve Aquatic Habitat

Peck Lake, Pool 9, Wisconsin

Island Protection and Restoration

Pool 8 Islands HREP Phase II, near Stoddard, Wisconsin

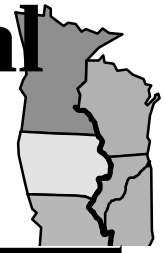


October 1961

August 1994

August 2000

UMRS Environmental Conceptual Model



Economic Model Outputs

Socio-political Model Outputs

Land use patterns

Forest Succession Models

Invasive Species Models

Wildlife and Habitat Suitability Models

Sedimentation, Runoff Models

(Nutrients, toxics)

Wetland Models

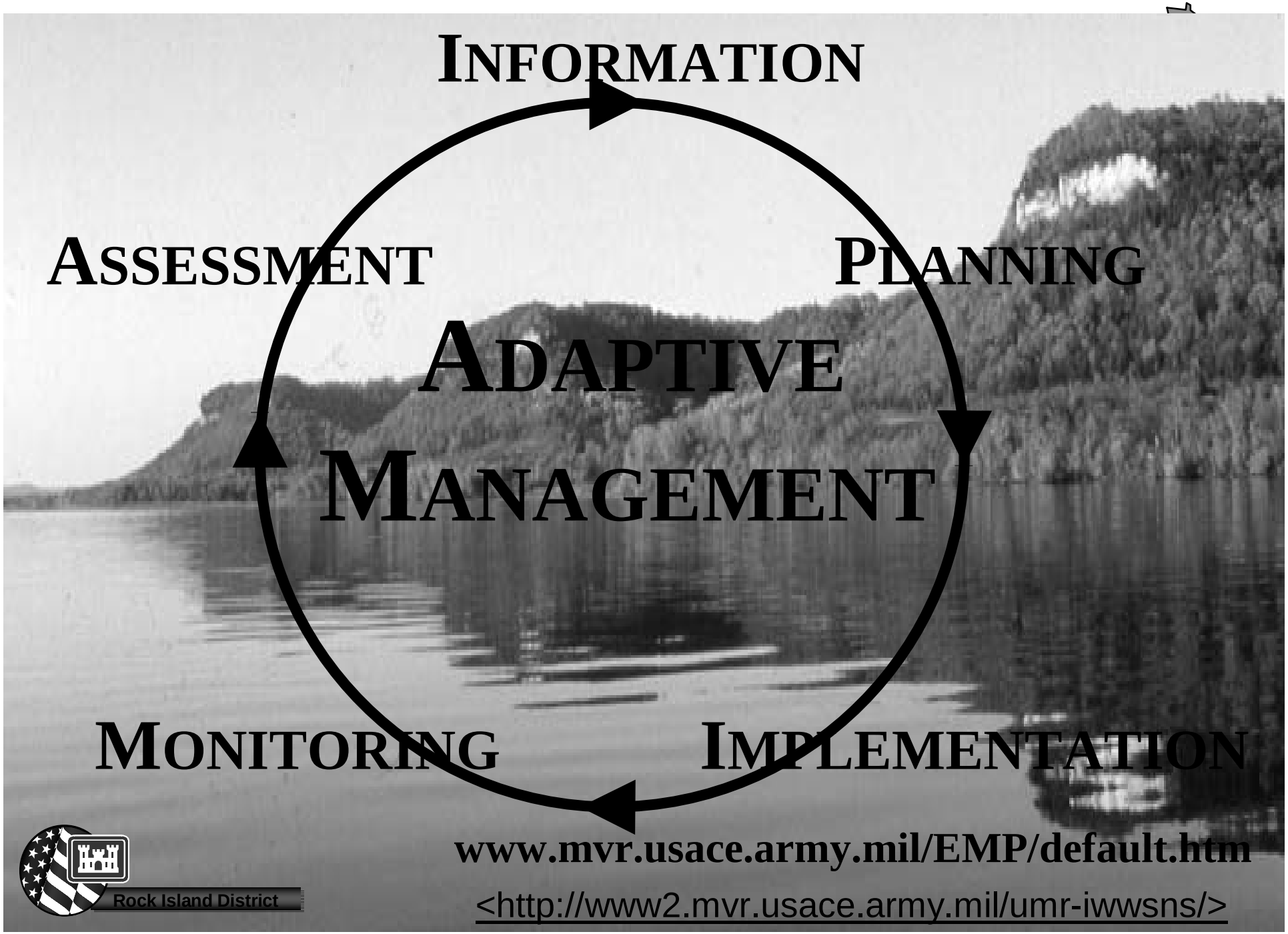
Aquatic Ecosystem Models

Bathymetry, Geomorphology

Discharge Regime, Hydraulics, Water Level Management

Environmental Management Plans

Impoundment, 9-foot channel project Navigation O&M

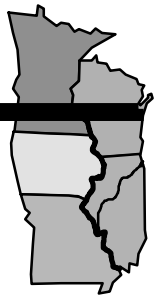


Rock Island District

www.mvr.usace.army.mil/EMP/default.htm

<http://www2.mvr.usace.army.mil/umr-iwwsns/>

COLLABORATION



USGS
science for a changing world

US Army Corps of Engineers

U.S. FISH & WILDLIFE SERVICE

Corporations

Levee Districts

UMRS-EMP

Minnesota DEPARTMENT OF NATURAL RESOURCES

WISCONSIN DEPT. OF NATURAL RESOURCES

DNR

Illinois Department of Natural Resources

PUBLIC

CONSERVATION DEPARTMENT MISSOURI

NGO's